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EXAMINER

KIELIN, ERIK J

ART UNIT

PAPER NUMBER

2813

DATE MAILED: 01/21/2003

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/042,358

Applicant(s)

ONG ET AL.

Examiner

Erik Kielin

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 09 January 2003.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-35 is/are pending in the application.
- 4a) Of the above claim(s) 2, 11-21, 23, 24, 26, 28-31 and 33-35 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1, 3-7, 9, 10, 22, 25, 27 and 32 is/are rejected.
- 7) ☒ Claim(s) 8 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 11 January 2002 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) ✓
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 3. ✓
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

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DETAILED ACTION

Election/Restrictions

1. Applicant's election with traverse of the species of Group I, claims 1, 3-10, 22, 25, 27, and 32 in Paper No. 7 is acknowledged. The traversal is on the ground(s) that the search would not burden examiner. This is not found persuasive because burden of search has been established by the plurality of unrelated chemical formulas.

The requirement is still deemed proper and is therefore made FINAL.

2. Claims 2, 11-21, 23, 24, 26, 28-31, and 33-35 are withdrawn from further consideration pursuant to 37 CFR 1.142(b), as being drawn to a nonelected species, there being no allowable generic or linking claim.

Information Disclosure Statement

3. The information disclosure statement filed 11 January 2002 fails to comply with the provisions of 37 CFR 1.97, 1.98 and MPEP § 609 because the article by Garnier et al. is illegible. It has been placed in the application file, but only those references initialed by Examiner have been considered. Applicant is advised that the date of any re-submission of any item of information contained in this information disclosure statement or the submission of any missing element(s) will be the date of submission for purposes of determining compliance with the requirements based on the time of filing the statement, including all certification requirements for statements under 37 CFR 1.97(e). See MPEP § 609 ¶ C(1).

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Drawings

4. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they do not include the following reference sign(s) mentioned in the description: 64 (p. 29, line 21). A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Claim Objections

5. Claim 8 is objected to because of the following informalities:

in line 2, after "trimethylsiloxyalkyl" remove the comma and insert --or-- for clarity; and

in line 3, replace "alkyl" with --the alkyl portion-- for clarity.

Appropriate correction is required.

Specification

6. The lengthy specification has not been checked to the extent necessary to determine the presence of all possible minor errors. Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

7. The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.

The following title is suggested:

Polythiophenes and Electronic Devices Made Therefrom

Claim Rejections - 35 USC § 112

8. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

9. Claim 9 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claim 9 further limits the monomer "A" of independent claim 1. However, it is unclear, as presently written if "A" is required since independent claim 1 indicates that "z," the number A monomers in the polythiophene oligomer may be 0. For the purposes of patentability, it is assumed that $z=1$ in claim 9.

Claim Rejections - 35 USC § 102

10. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

11. Claims 1, 5, 6, 9, 10, 22, and 25 are rejected under 35 U.S.C. 102(b) as being anticipated by US 5,347,144 (**Garnier et al.**).

Regarding independent claim 1, **Garnier** discloses an electronic device (a thin film transistor or TFT), comprising a substrate, gate electrode (called "conducting grid"), gate dielectric, and source/drain electrodes (col. 2, lines 20-29; col. 6, lines 19-47) and a semiconductor layer comprising a polythiophene derived from monomer segments shown in col.

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4, line 35 to col. 5, line 21, labeled as formula "(III)." **Garnier** discloses the polythiophene of formula (III) shown in col. 4, to have the following substituent groups:

X and X' independently represent O, S, Se, Te, or --N(R)--,

R represents H, alkyl, substituted alkyl, aryl, or substituted aryl;

R₁, R₂, R'₁, R'₂, R₃, and R''₃ each independently represent --H, Cl, F, or a --CF₃, --NO₂, --CN, --COOR₃ group, --N(R₄)(R₅), alkyl, substituted alkyl, aryl, substituted aryl, alkoxy or polyalkoxy,

R₃ represents an alkyl or substituted alkyl group or a metal,

R₄ represents H or an alkyl or substituted alkyl group,

R₅ represents an alkyl, acyl, or aryl group or R₁ and R₂ and/or R'₁ and R'₂ pairs together represent a divalent hydrocarbon group which may be unsaturated or possibly interrupted and/or terminated by at least one heteroatom,

Y, Y₁, Y₂, and Y₃ independently represent the following groups: --C(R')=C(R'')-- --C≡C-- --N(R')-- --N=N-- --C(R')=N-- --N=C(R')--, wherein R' and R'' independently represent --H, alkyl, substituted alkyl, aryl, or substituted aryl,

a, b, a', b' are numbers equal to 0 or 1, or Y₁ may also represent a cyclic or heterocyclic arylene group, and in this case b=1 and a'=0,

s and t are whole numbers, including zero, of which at least one is different from zero,

m' is a whole number equal to at least 1, the numbers s, t, and m' are such that

$$m'(s+t)=m,$$

m being a whole number between 4 and 24.

In the oligomer with formula III, units A and A' can alternate regularly or not. In addition, in a given oligomer, the substituents and/or heteroatoms of the units can be different.

In the instant case, monomers A and A' in **Garnier** are the equivalent of the instantly claimed R_m-substituted and unsubstituted thiophene monomers of the instantly claimed formula (I). The sidechains R₁, R₂, R'₁, R'₂, in **Garnier** are equivalent to the instant sidechain R_m, because any of R₁, R₂, R'₁, R'₂ may be hydrogen or the non-hydrogen substituents, as indicated

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above. Any of Y to Y₃ in **Garnier** corresponds to the A monomer of the instant formula (I). Only one of the subscripted Y's or Y is required since a, a', b, and b' may be zero.

Regarding claims 5 and 6, R (one of R₁, R₂, R'₁, R'₂, in Garnier) may be alkyl containing from about 6 carbon atoms to about 12 (instant claim 5) or 4 to 12 carbons (instant claim 6) because "alkyl" is defined as the hydrocarbon groups. The remaining substituents may be hydrogen.

Regarding claims 9 and 10, as noted above, D (one of Y to Y₃ in Garnier) "Y₁ may also represent a cyclic or heterocyclic arylene group" as noted above in the excerpt from Garnier. Garnier shows a cyclic arylene group which is phenylene (col. 3, line 38). Accordingly, D (one of Y to Y₃ in Garnier) may be, *inter alia*, phenylene, which has 6 carbons.

Regarding claim 22, the instant n corresponds to the Garnier m' which, as noted in the excerpt above may be 4 to 24 which overlaps 5 to 5000.

Regarding claim 25, as noted above with regard to claims 5 and 6, the instant R of formula (I) may be alkyl in the Garnier formula and therefore anticipates the presently claimed alkyl groups and m=1 corresponds to, for example, R₁ of Garnier being the alkyl group and the other R₂, R'₁, and R'₂ substituents are hydrogen. The instantly claimed x=y=2 corresponds to the Garnier s and t which are indicated to be a whole number greater than zero. Instant z is claimed to be 0 or 1 which as noted with regard to claims 9 and 10 above may be 0 or 1.

Claim Rejections - 35 USC § 103

12. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

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(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

13. Claim 32 is rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over **Garnier**.

Although **Garnier** does not indicate the claimed method of depositing the polythiophene, method limitations, such as spin coating, stamp printing, etcetera, as instantly claimed, do not have patentable weight in device claims. Note that a “product by process” claim is directed to the product per se, no matter how actually made, *In re Hirao*, 190 USPQ 15 at 17 (footnote 3). See also *In re Brown*, 173 USPQ 685; *In re Luck*, 177 USPQ 523; *In re Fessmann*, 180 USPQ 324; *In re Avery*, 186 USPQ 161; *In re Wertheim*, 191 USPQ 90 (209 USPQ 554 does not deal with this issue); *In re Marosi et al*, 218 USPQ 289; and particularly *In re Thorpe*, 227 USPQ 964, all of which make it clear that it is the patentability of the final product per se which must be determined in a “product by process” claim, and not the patentability of the process, and that an old or obvious product produced by a new method is not patentable as a product, whether claimed in “product by process” claims or not. Note that applicant has the burden of proof in such cases, as the above case law makes clear.

14. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over **Garnier** in view of US Patent Application Publication 2002/0053666 A1 (**Marks et al.**).

Garnier does not teach that the sidechains of the thiophene monomers may be perfluoroalkyl having from 2 to 15 carbons.

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Marks teaches the benefits of using perfluoroalkyl sidechains from 4 to 12 carbons (paragraph [0057]) on thiophene units in the production of polythiophene semiconductor materials to adjust the electron affinity and improve stability and volatility (Abstract).

It would have been obvious for one of ordinary skill in the art, at the time of the invention to make the alkyl sidechains of **Garnier**, perfluoroalkyl sidechains of 4 to 12 carbons, as taught by **Marks**, to achieve the benefits of improved stability and volatility and to be able to adjust the electron affinity.

15. Claims 1, 3, 4, and 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over WO 97/32914 (**Möhwald et al.**) considered with **Garnier**.

Regarding claim 1, **Möhwald** discloses a polythiophene having both substituted thiophene and unsubstituted thiophene units. (See paragraph bridging pp. 8-9 --especially formulas VII and VIII.) In the instant case, $z = 0$, such that no A monomer is present.

While **Möhwald** does not specifically indicate that the polythiophene is in an electronic device, he does indicate that the polythiophene has electrical conductivity and may be used as a semiconductor and is for industrial use. (See p. 5, line 20 to p. 6, line 13.)

Garnier, as noted above teaches the use of polythiophenes as a semiconductor in a thin film transistor (an electronic device).

It would have been obvious for one of ordinary skill in the art, at the time of the invention to use the polythiophene of **Möhwald** as the semiconductor layer in an electronic device because **Garnier** teaches that polythiophenes may be used as the semiconductor active layer in a TFT

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and because **Möhwald** teaches that the polythiophenes have used as semiconductors and are for industrial use.

Regarding claims 3 and 27, **Möhwald** discloses that the instant n (I in Möhwald) is 1 to 3000 (p. 9, lines 3-6) and the weight average molecular weight (M_w) is 1000 to 500,000 (with other indicated preferable ranges) and that the number average molecular weight (M_n) is $\frac{1}{2}$ to $\frac{1}{4}$ M_w , which is 250 to 125,000. Each is as measured by gel permeation chromatography using polystyrene standards. (See p. 16, lines 14-22.)

Regarding claim 4, R (X and/or Y in Möhwald) may be alkyl of 1 to 20 carbons (p. 6, lines 19-29) and the M_n and M_w are as indicated above.

(Note: US Patent 6,242,561 B1 (**Möhwald** et al.) is based upon the WO publication above.)

Allowable Subject Matter

16. Claim 8 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

17. The following is a statement of reasons for the indication of allowable subject matter:

The prior art does not teach or suggest, in combination with the other claimed limitations, an electronic device having the polythiophene of the formula (I) of claim 1 wherein the Replace sidechain is a siloxyalkyl of trimethylsiloxyalkyl or triethylsiloxyalkyl.

Conclusion

18. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

US 6,445,122 B1 (**Arai** et al.; col. 10, line 50) and US 6,242,561 B1 (**Möhwald** et al.; col. 5, lines 10-30) each teach polythiophenes which anticipate at least independent claims 1 and 16.

US 5,069,823 (**Sato** et al.) teaches the production of electrically conductive polythiophenes such as those disclosed by the general formula (III) in **Garnier**, wherein the weight average molecular weight is between 60,000 and 100,000 which overlaps the instantly disclosed ranges (See Abstract; col. 1, lines 19-33.)

US 6,320,200 B1 (**Reed** et al.) teaches polythiophenes for electrical applications as shown the formulas in cols. 29-32 and teaches the instantly claimed central thiophene monomers in the oligomer having an even number (formula 27) or odd number (formula 23) of the B side chain, wherein B is hydrogen.

US Patent Application 2002/0053320 A1 (**Duthaler** et al.) teaches a TFT and method of forming said TFT having the substrate, gate and source/drain electrode, and gate dielectric materials of instant claims 12, 15, 32, and 33, as well as the methods for depositing these semiconductor device features in instant claims 13 and 14 (albeit not having patentable weight). (See paragraphs [0034] through [0038], [0061], and [0078].)

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Any inquiry concerning this communication or earlier communications from the examiner should be directed to Erik Kielin whose telephone number is 703-306-5980. The examiner can normally be reached on 9:00 - 19:30 on Monday through Thursday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead, Jr., can be reached at 703-308-4940. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9318 for regular communications and 703-872-9319 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.



Erik Kielin
January 15, 2003